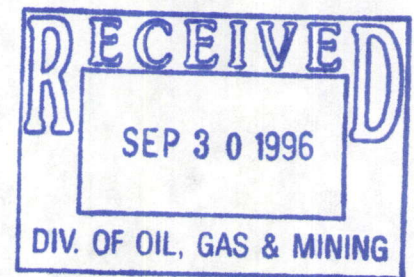


**SILVER CITY OPERATIONS  
HEAP CLOSURE PLAN**

**Prepared By:**  
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Denver, CO, 80202  
(303) 294-0427  
FAX (303) 293-2235



**Prepared For:**  
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**September 1996**

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## 1.0 INTRODUCTION

The Ground Water Quality Discharge Permit for the North Lily Heap Leach Facility, Permit No. UGW230001, expired on May 28, 1996. By letter dated April 26, 1996, North Lily requested permit renewal. On August 14, 1996, WQD authorized operation of the facility until November 28, 1996 under the conditions of the original permit. The Agency has requested submittal by September 28, 1996 of a complete Closure Plan for the facility as a condition of permit renewal. A complete Closure Plan includes the following elements: regrading and contouring plan; a neutralization plan; a cover design; a revegetation plan; a leachate management strategy; and a fluid disposal plan. This document represents North Lily's Closure Plan for the Silver City Heap Leach Facility.

The Closure Plan has been developed utilizing Technology Screening techniques where appropriate and it incorporates the Observational Approach to plan development where necessary. As an example, technology screening was used to select bioremediation of the heap. Chemical cyanide destruction was not the selected technology although this technology remains available in the event that laboratory bioremediation testing yields less than satisfactory results (observational approach). Listed below is the status of each element of the Closure Plan.

Section	Element	Status
2	Regrading and Contouring Plan	WQD Approved
3	Neutralization Plan	Approval Requested
4	Cover Design	Conceptual Design
5	Revegetation Plan	DOGM Approved
6	Leachate Management Strategy	Conceptual Design
7	Fluid Disposal Plan	Conceptual Design

It is understood by North Lily that additional information is required to allow WQD to approve the detailed Closure Plan. However it is believed that this document provides sufficient detail to allow WQD to approve the conceptual Closure Plan, the detailed Neutralization Plan and to renew the operating permit with conditions on a timely basis.

## 1.1 Certification of Submitted Information.

W. Gene Webb

(Name of Company Official)

, Executive V.P.

(Title)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: [Signature]Date: September 26, 1996

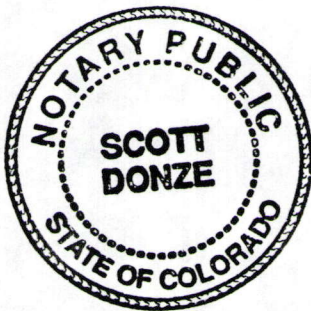
SUBSCRIBED AND SWORN to before me this 26<sup>th</sup> day of September  
19 96.

My commission expires on the 23<sup>rd</sup> day of September, 19 97.

[Signature]

Notary Public in and for

(seal)



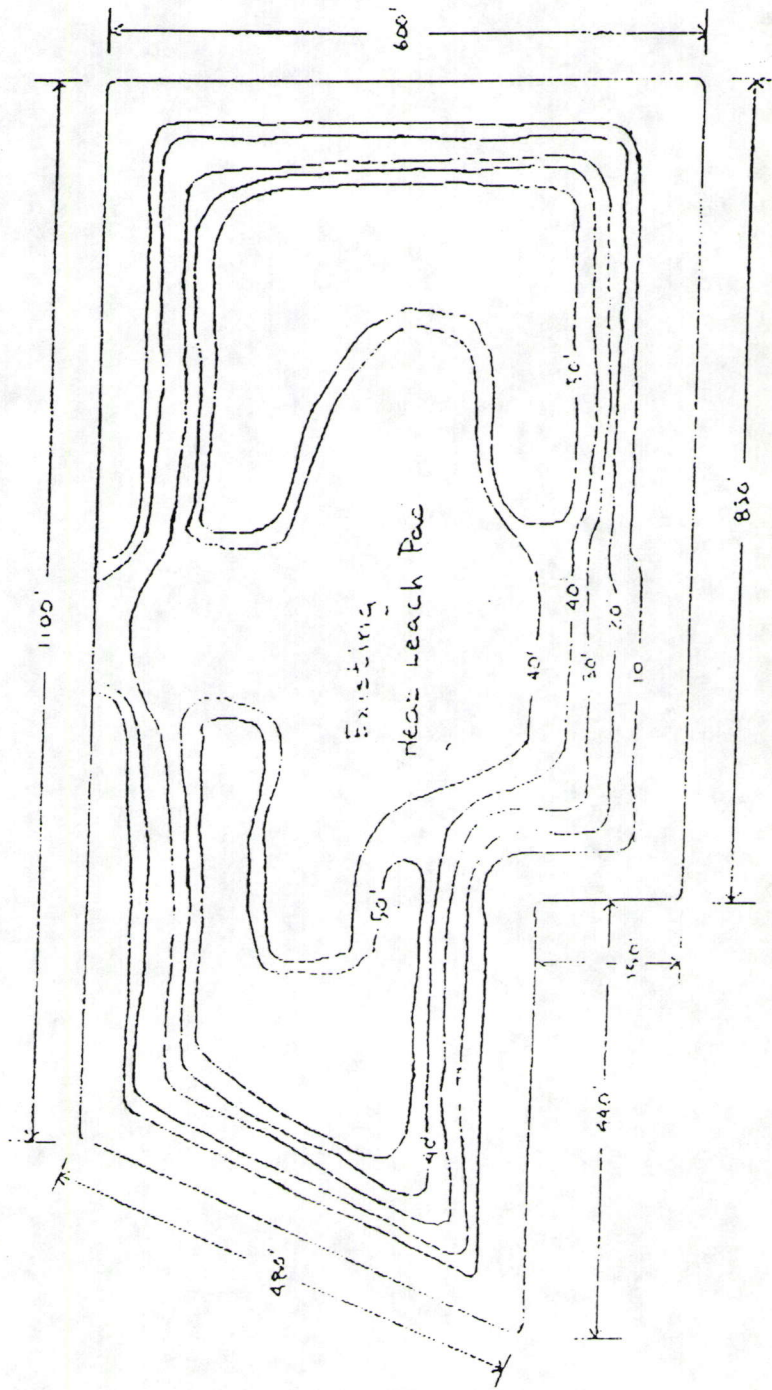
## 2.0 REGRADING AND CONTOURING PLAN

The closure grading plan was submitted to WQD and DOGM on July 12, 1996. The plan was revised on August 21, 1996 based upon the Agency comment letter of August 14, 1996. The grading plan described below was approved following Agency review of comment responses.

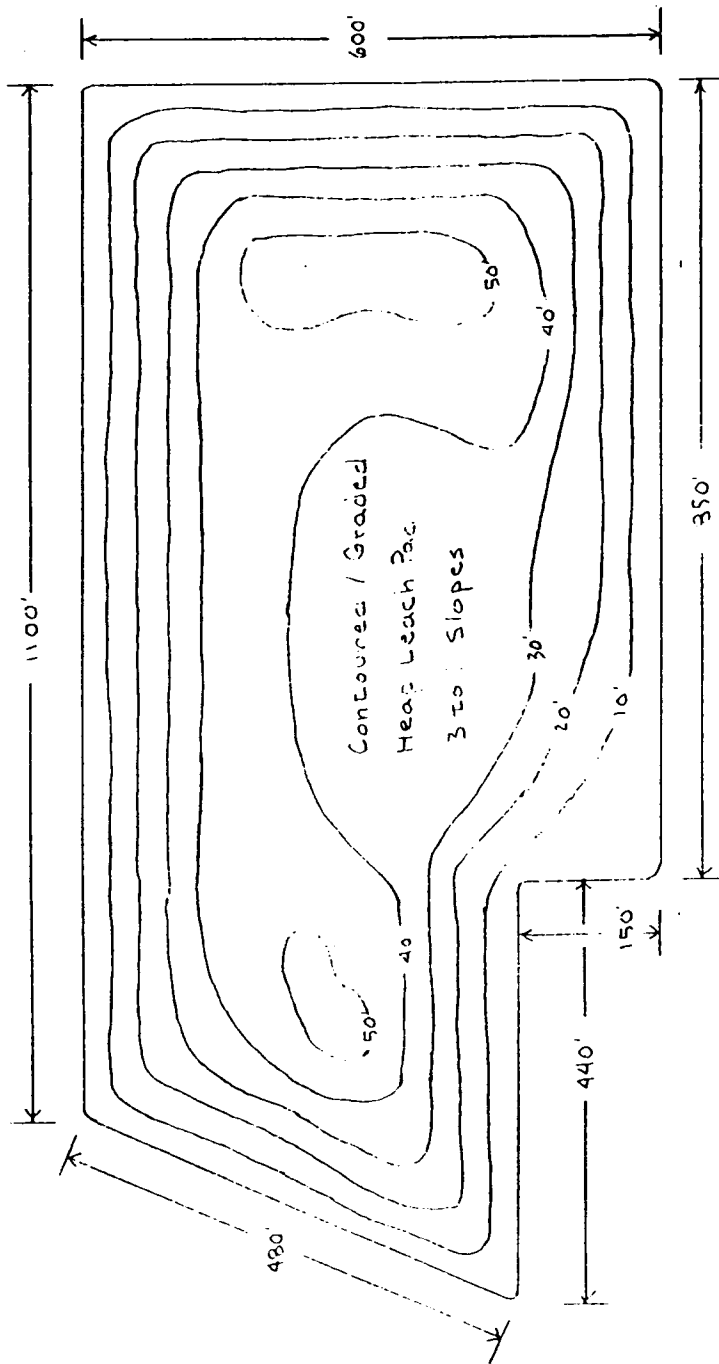
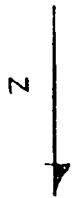
The heap will be graded and contoured using dozers, scrapers, and other heavy equipment. Care will be taken to prevent spent ore from being pushed off of the pad. Overall slopes will be reduced to 3 to 1. The top of the heap will be graded to obtain a 3 to 5 percent slope eliminate ponding and to create positive drainage from the heap.

Spillways on the down slope side of the heap leach pad will have a 6 inch cushion of finely crushed material placed in the bottom of the spillway to protect the liner. A 4 inch perforated pipe will be placed on top of the fine material in the bottom of the spillway to transport runoff from the graded, contoured heap. The cushion and perforated pipe will be overlaid by a filter fabric, coarse gravel and growth media. Fluid from the heap will be routed through this system to report to the leachate treatment facility (Section 6).

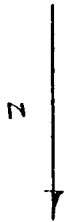
Plans and sections of the current and regraded heap follow.

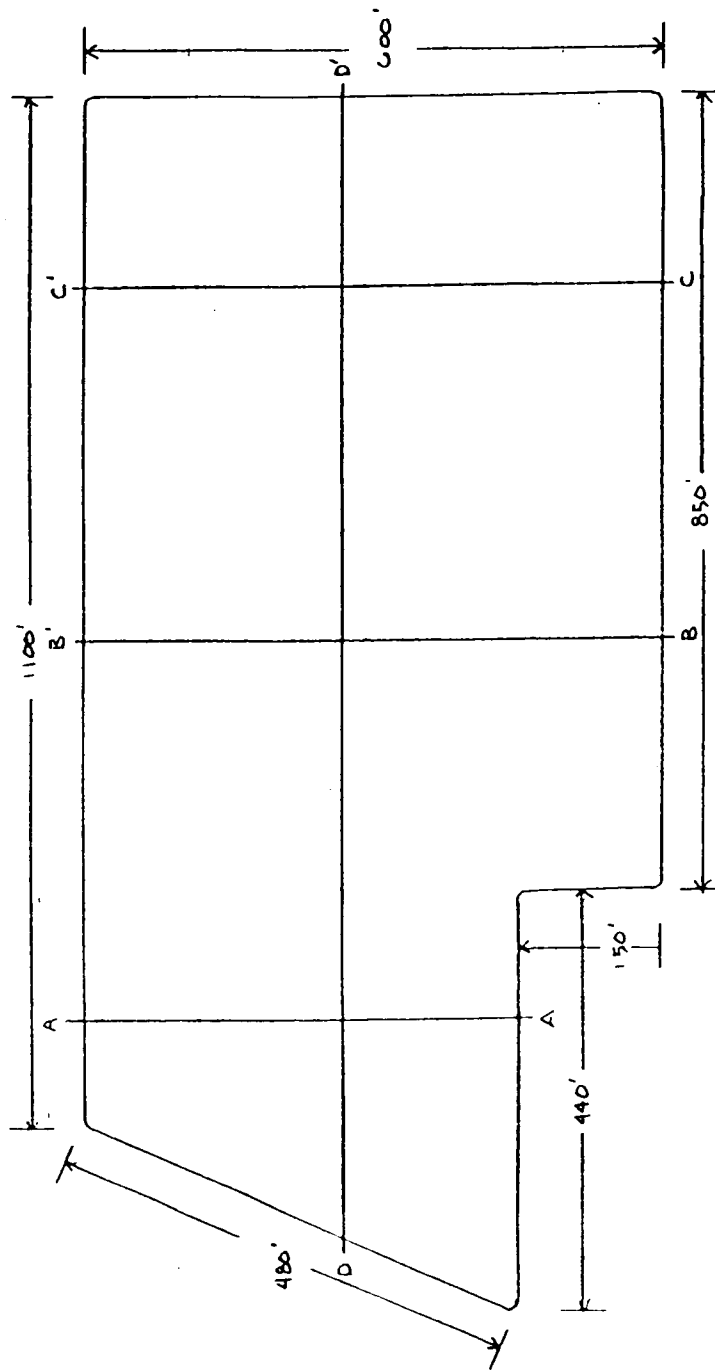


Existing Heap Leach Contour Map  
 North Lilly Mining Co  
 Scale: 1" = 200'  
 Date: July 1996  
 By: Paul Spor

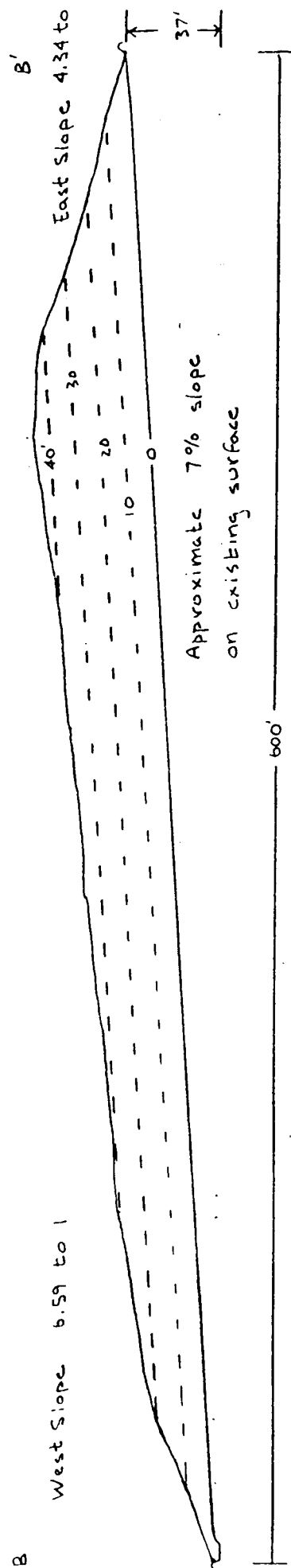
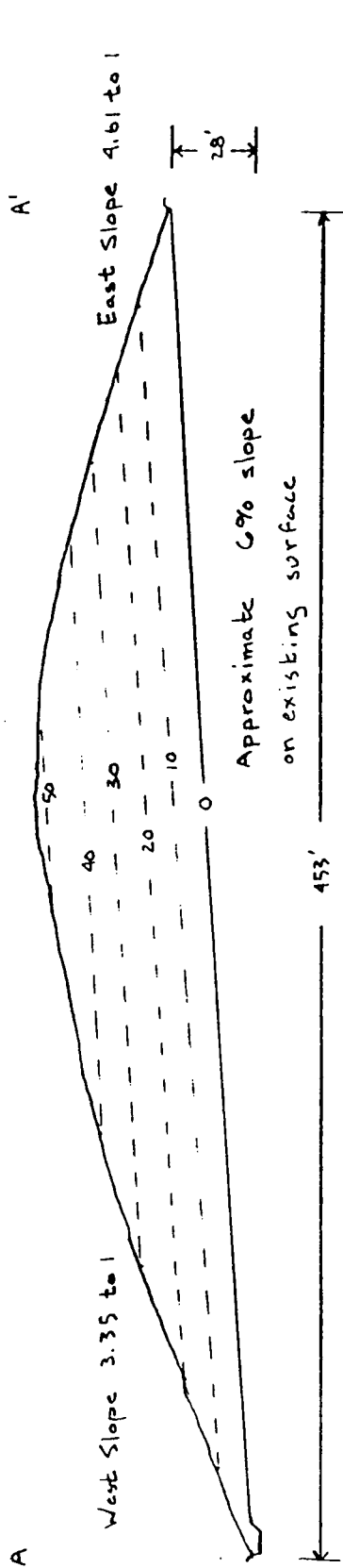


Proposed Heap Leach Contour Map  
North Lilly Mining Co.  
Scale: 1" = 200'  
Date: August 1996  
By: Paul Spor  
Figure: 1 of 4

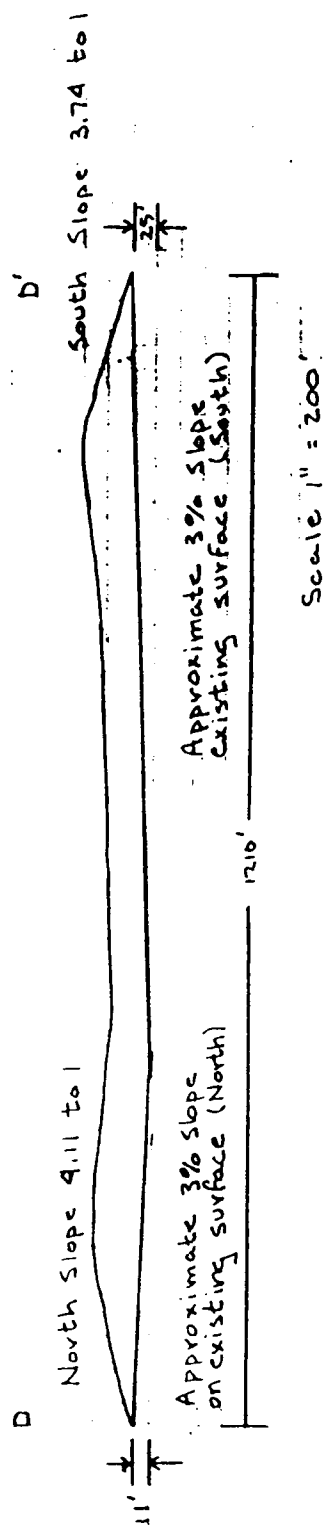
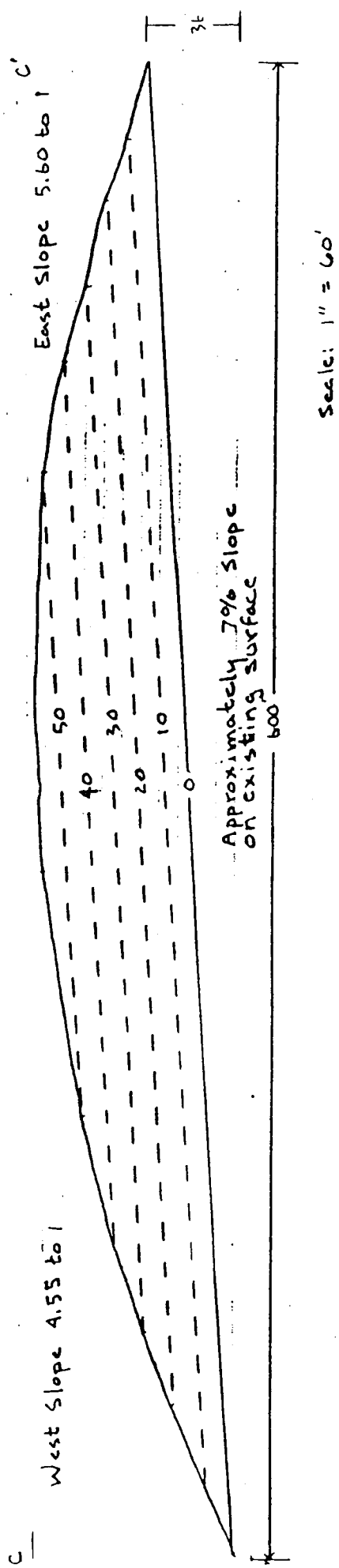




Cross Section Location Map  
 North Lily Mining Company  
 Scale: 1" = 200'  
 Date: August 1996  
 By: Paul Spor  
 Figure 2 of 4



Cross Section A-A' & B-B'  
 North Lily Mining Company  
 Scale: 1" = 60'  
 Date: August 1996  
 By: Paul Spar  
 Figure: 3 of 4



Cross Section C-C' & D-D'

North Lily Mining Company

Date: August 1996

By: Paul Spar

Figure: 4 of 4

### 3.0 NEUTRALIZATION PLAN

North Lily ceased adding cyanide to process solutions in 1993 while continuing to circulate solution. In November 1994 a carbon plant was installed to recover precious metals from the circulating load. Use of the carbon plant was discontinued in late 1995. Over the period from 1993 to the March 1996 sampling, cyanide and metals concentrations in process solutions have been declining due to flushing by incident precipitation and natural degradation mechanisms. As examples, WAD cyanide has declined from 1264 mg/l to 153 mg/l and copper has declined from 1110 mg/l to 162 mg/l. While a tenfold reduction of contaminants has been recorded, process solutions contain cyanide and metals at concentrations in excess of those levels required for permanent closure of the facility.

During spring and summer 1996, North Lily conducted a technology screening program designed to identify available methods for reduction of cyanide and metals in off flow from the heap. The two methods showing most promise are chemical destruction of cyanide and bioremediation of the heap. These methods are well known and have been proven during closure of large scale production heaps.

While chemical destruction using alkaline chlorination offers the advantage of rapid cyanide destruction, this technology requires the addition of considerable quantities makeup water for heap flushing. Following cyanide destruction the water would have to be disposed of by land application. Chemical cyanide destruction offers little opportunity for substantial reductions in metals concentrations. Bioremediation, while requiring a longer time to reduce cyanide concentrations, has proven effective in metals concentration reduction in heap effluent.

Based on comparison of the two technologies, North Lily has decided to utilize bioremediation technology to neutralize the heap. Essentially bioremediation of the heap will include two stages which are laboratory evaluation and full-scale biodetoxification. Laboratory evaluation requires about two months. During this stage, solutions and bacteria are collected from the Silver City heap, evaluations are completed and scale-up criteria are developed. The scale-up criteria are developed by use of a continuous bench-scale reactor. In the bioreactor, nutrient mixtures are tested and scale-up parameters, such as residence time, mixing, aeration requirements are determined. The purpose of the bioreactor is to grow large numbers of bacteria in a short period of time. The bacterial populations in the bioreactor effluent will be closely monitored to determine the effects of various parameters. Concentrations of WAD cyanide, copper, arsenic, mercury and nitrate will be monitored.

At the conclusion of the laboratory stage, the long term effectiveness of bioremediation will be able to be predicted. In the event that the laboratory test program is not successful, North Lily could determine that chemical destruction of cyanide would produce better results and implement that competing technology.

The design of the full-scale reactor is dependent upon the laboratory stage results. It appears that much required equipment is already at Silver City which can be converted to bioremediation use. Following set-up of the equipment, bacteria will be grown in the full-scale bioreactor. The entire heap will be inoculated during a two to three month period by moving the irrigation system across the heap to ensure full coverage. Detoxification of the heap is estimated to require between five and twelve months. During this period, the heap will continue to be rinsed and bacteria will be added to the rinse solution.

During full-scale bioremediation, the run-off solution will be sampled and analyzed twice monthly for WAD cyanide, total cyanide and indicator metals. Initial indicator metals include arsenic, copper, mercury and nickel. Concentrations will be plotted and when it is determined that no further advantage can be gained by continued rinsing, circulation of solutions will cease, the heap will be allowed to drain, and the heap will be capped.

#### 4.0 COVER DESIGN

The heap cover is one component of the overall system designed to minimize the potential of effluent from the closed heap to affect ground water. The other components are the Reclamation Plan (Section 5) and the Leachate Management Strategy (Section 6). The design of the cover will be principally driven by two factors which are the expected quality of the effluent following bioremedial treatment and the capacity and ability of a passive system to treat the expected effluent. A technology screening process has identified three heap capping methods available for closure of the Silver City heap. Following lab testing, the quantity of effluent expected to drain from the heap will be estimated utilizing the Hydrological Evaluation of Landfill Performance (HELP) model. A brief description of each cover design is below.

1. **Compaction of Spent Ore** - Following completion of heap grading and contouring, two samples of spent ore will be collected and sent to a commercial lab for analysis. A standard suite of compaction and permeability tests will be conducted. The goal of this program will be to determine the overall compaction and resultant permeability which can be achieved by compaction of spent ore. Based on visual examination of the spent ore and experience with similar materials, it is expected that permeability's of approximately  $1 \times 10^5$  cm/sec. or lower can be achieved. Suitable compaction would be achieved by walking a bulldozer in an upslope direction. The surfaces would be sealed by repeated equipment passes. Alternatively, should test results indicate significantly improved permeabilities, the top 24 inches of the heap surface would be compacted in 6 inch lifts by use of heavy equipment.
  2. **Installation of a Gravel Drain Layer** - In the event that the compacted spent ore model results indicate an unacceptable quantity and quality of effluent, the performance of a 12 inch gravel drain layer over the compacted spent ore and under the replaced soil layer would be evaluated. The purpose of the gravel drain layer would be to reduce the amount of infiltration to the heap. The gravel would be locally obtained from North Lily's property.
  3. **Installation of an Enhanced Cover** - In the event that the compacted spent ore model results indicate an unacceptable quantity and quality of effluent, the performance of an enhanced cap would be evaluated. The modified cap would include addition of suitable clay or bentonite to the compacted spent ore to further reduce permeability.
- Following completion of the test and modeling results, a cover design would be selected and constructed.

## 5.0 REVEGETATION PLAN

Reclamation of the Silver City heap will include the placement of topsoil over the graded, compacted heap and seeding, mulching and fertilization in accord with the DOGM approved Reclamation Plan which is appended to this Closure Plan. There is adequate salvaged topsoil available to implement the plan. The operator has demonstrated the technical feasibility of the proposed Reclamation Plan by successful reclamation of the mine waste dumps which were the source of ore for the heap leach project. Revegetation success criteria have been established by DOGM.

## 6.0 LEACHATE MANAGEMENT STRATEGY

If necessary, effluent from the heap will be managed by routing it to a wetland system for passive treatment prior to release. There are basically two types of wetlands; natural and manmade. These systems have been successfully applied in the partial treatment of heap effluent in the west. The effectiveness of engineered systems is generally confined to flows of less than 100 gpm due to size limitations and exhibit metals removal efficiencies in the range of 50-75%. The decision to utilize either a simple constructed wetland system or more complex anaerobic bioreactor will be driven by the expected quality of the effluent following bioremedial treatment and the expected flow to the system from the capped, revegetated heap. Based upon an informed review of the site, climatological data and the expected performance of the heap cap and revegetation plan, it is expected that flow to the passive treatment system would average less than 10 gpm. The conceptual design of the passive treatment system and expected effects on ground water underlying the Silver City site would be reviewed with DEQ prior to construction of the proposed system.

Water would be directed from the heap pipe collection system to the passive treatment system. In the event that a manmade wetland is constructed, it may be preferable from a water quality standpoint to route the flow via an open ditch. Otherwise the flow will be routed via pipe. In any event, provision would be incorporated into the system to allow flow measurement and for the collection of water quality samples both above and below the passive treatment system. Treated effluent would be released via infiltration from a wetlands system or by a leach field if an anaerobic bioreactor were constructed. Ground water is located at a depth exceeding 300 feet in the Silver City area and clay seams are known to exist between the surface and the local water table.

## 7.0 FLUID DISPOSAL PLAN

It is planned that excess fluids from the heap flushing process will be disposed of by land application. This system of fluid disposal is well proven. The most significant benefit of direct land application relates to the attenuation of metals and not the evaporation of solution. The land application system would be operated in a manner to exclude overland flow and maximize infiltration and percolation of solution into the soils.

In addition to the possibility of applying excess rinse solutions to the seeded heap for irrigation, the operator has identified two potential areas for land application in close proximity to the Silver City heap. Both areas are private and controlled by North Lily. Soil samples were collected from both areas and submitted to the Colorado State University Soils Lab for analysis. All soils showed substantial capacity to adsorb metals without exceeding concentrations considered harmful to plant growth. The soil and rinse solution concentration data will be reviewed prior to implementation of land application of excess fluids.

**APPENDIX 1**  
**SILVER CITY OPERATIONS**  
**RECLAMATION PLAN**

## E.1 INTRODUCTION

The purpose of the reclamation plan is to provide a site-specific practical workable solution to interim and final reclamation of the site. The proposed project site was visited on a field trip in October 1987 to study present conditions on the site vegetation, wildlife topsoil, and substrate conditions and amounts, and other conditions affecting the reclamation of old tailing dump and the present proposed operations. Information on the project site is available from previous baseline studies conducted by NPI and SRK on this site. Aerial photographs of the site were examined and ground photos were taken of the site. Soils and other material samples were taken and analyzed for chemical and physical parameters important in revegetation. Additional information on techniques and plant materials for reclamation for the project site was obtained from the local office of the U.S. Soil Conservation offices, and the Utah Oil, Gas and Mining Division.

The goal of the reclamation is to reclaim the site where possible to a productive vegetation and wildlife habitat, and primarily to stabilize the site to prevent erosion and sedimentation. The site has adequate soils material that can be salvaged, and the climate and local conditions should allow a successful reclamation program.

## E.2 RECLAMATION TECHNIQUES AND METHODS

The reclamation methods proposed for the Tintic Project follow established techniques that are designed generally for this region in the Great Basin in Utah. The methods depend on the area to be reclaimed, type of disturbance, and the use of the land after reclamation.

### E.2.1 Reclamation Phasing

During construction, the initial phase will consist of detailed planning and final field work to coordinate the interim and final reclamation with construction and ongoing operation plans. Available topsoil on the leach pad and process facilities area will be identified, then stripped and stockpiled. The topsoil stockpile will be stabilized and planted with a cover crop to control erosion and weeds after the tailings area is reclaimed.

After the leach pads are constructed in early 1988, the entire tailings dump will be moved and this area, including unused portions of the haul road will be graded, topsoiled, and revegetated during the fall season. This area will be reclaimed using the techniques and seeding rates discussed in this reclamation plan. The final reclamation then will involve only the leach heaps and process area plus access roads that will no longer be used. The reclamation site will continue to be monitored and protected until a good vegetation stand has been established.

### E.2.2 Soil Salvaging and Handling

All available topsoil and subsoil that is suitable for plant growth will be stripped from the areas to be disturbed in the construction phase. The total undisturbed acreage that can be stripped is about 14 acres.

Assuming that about 18 inches based on soil profiles and laboratory tests can be stripped from the topsoil and subsoil in these areas, there will be about 34,000 cu yds, which is enough material to reclaim the tailings area and the leach pad sites.

The soil will be stripped prior to construction using available equipment onsite. The topsoil will probably be picked up directly with scrapers and hauled to the topsoil stockpile. After removing the soil to be used on the old tailings dump area, the stockpile will be graded and stabilized with slopes no steeper than 2.5 to 1 and planted using conventional techniques with a cover crop of vegetation using the species in the seeding section.

### E.2.3 Suitability of Topsoil for Revegetation

The topsoiling materials available onsite were studied for revegetation potential by observations onsite, information in the soils report, and laboratory analysis of samples collected during the field surveys. The soil and substrate sample characteristics have been previously discussed in the soils section. For undisturbed soil profiles, the results of this information and tests include that from 12 to 14 inches of topsoil can be removed, and that the best estimate of average depth is 18 inches for these soils. There is some variation in soil type and depth depending on topographic position, but in general, the loamy soils on the alluvial fans, or the layers of cobbles in the alluvial substrate in the areas of the leach pads. Every effort will be made to save all suitable topsoiling material.

The laboratory analyses indicate that these soils are generally deficient in organic matter and nutrients (nitrogen and phosphorous), and have a basic pH with high amounts of lime. These conditions are generally not a problem with revegetation to rangeland grass and shrubs which are adapted to these conditions. However, in order to ensure good vegetative growth and productivity in a short period, the following amendments will be used based on recommendation of the Oil, Gas and Mining specifications:

Fertilizer

Diammonim phosphate at 200 lbs/acre

Mulch

2 tons of straw or weed free hay/acre

### E.3 SEEDING MIXTURES AND PLANTING RATES

The following recommended seeding mixtures are based on recommendations from the reclamation specialist at the Oil, Gas and Mining Division. The project site assumed to have 14 inches of average annual precipitation principally during the later winter and early spring as rain or snow.

Actual species that will be used on the site visit will depend on availability at the time when the two major areas onsite will be seeded and reclaimed.

The following species form the basic seed mixture that will be seeded on the site in most areas to be reclaimed such as haul roads, leach pads, and the facilities areas. The rate of application will be 20 lbs pure live seed per acre drilling and double this rate for hand broadcasting.

#### BASIC LIST OF RECOMMENDED PLANT SPECIES FOR SEEDING AT THE TINTIC PROJECT SITE

<u>Plant species</u>	<u>Variety of Cultivar</u>	<u>Seeding Rate</u> lbs PLS/acre
Grasses:		
Agropyron cristatum (crested wheatgrass)	Fairway, Ephraim	5
Agropyron smithii (Western wheatgrass)		4
Oryzopsis hymenoides (Indian ricegrass)	Paloma	2
Forbs:		
Medicago sativa	Ladak	4
Shrubs:		
Atriplex canescens (fourwing saltbrush)		3
Purshia tridentata (bitterbrush)		2

In addition to the basic seed mixture, there is a need for a quick stabilizing revegetation on temporary surfaces such as topsoil stockpiles, road cut and fill areas. Some of these plant species help control weeds, and provide a pulse crop for permanent revegetation. The following species are recommended with annotations for specialized use on the project site:

1. Ryegrasses (*Lolium* species); may be planted with clovers to provide quick vegetative cover and green manure crop in temporary areas than later can be moved or disced and seeded to the basic seed mixture; and
2. Alfalfa (*Medicago sativa* 'Ladak'); may be planted in the same places as ryegrass for soil improvement and weed suppression.

#### E.4 SITE DECOMMISSIONING AND CLEANUP

At the completion of operations, the site will be decommissioned by neutralizing the leach heaps as discussed in Exhibit B. The buildings will be removed, and the foundations broken up and disposed. The site will be cleaned of all debris and trash and disposal of in an approved manner.

#### E.5 GRADING, STABILIZATION, AND DRAINAGE CONTROL

During the short construction period, drainage will be routed and controlled to prevent erosion and sedimentation on the project site. The drainage channel will be constructed to prevent the proposed facilities from storm events as discussed in Exhibit B. Final grading will reestablish drainage across the project site, and reduce most slopes on the leach pads to 3H:1V for revegetation. The old tailings dump area will require very little regrading since it has relatively flat slopes. Figure E.1 is a plan view map of the final reclamation contours and drainage.

#### E.6 SURFACE AND SEEDBED PREPARATION

The surfaces of the areas to be revegetated after grading and sloping, drainage and sediment control, and where applicable had topsoil placed, will be prepared as a seedbed using the following procedures:

1. The density of the surfaces will be loosened and left in a rough condition by ripping or other mechanical means. Some surface that have a loose erodible slope may be dozer tracked to prevent sloughing where amendments, seed, and hay are to be applied;

2. Amendment and seedbed materials will be the detailed reclamation plans. This material should be applied for even spreading using a minimum of passes and equipment;
3. The surfaces with the applied amendment will be disced, raked, or otherwise treated to incorporate fertilizer into the top 4 to 6 inches;
4. The prepared surface will then be seeded using the mixtures and amounts recommended. Seeding can either be by range-drill using the depths and rates specified. Other methods of seeding are broadcasting using spreader, or in small areas or marrow strips by hand; and
5. Hay or other protective mulch will then be applied, if necessary, and crimped or otherwise anchored.

#### E.7 RECLAMATION SCHEDULING

The deadline scheduling for reclamation will be planned around the climatic conditions and season most suited for activities:

- . Grading and drainage control in mid to late summer;
- . Seedbed preparation in late summer or early autumn so the surface is prepared no more than a few weeks before seeding;
- . Seed the main areas during final reclamation during the mid to late fall to take advantage of winter and spring moisture; and
- . Seed cover and stabilization areas during late fall or early spring depending on the plant species and area involved.

#### E.8 MONITORING

The reclamation areas will be monitored for a period of two years to ensure that the revegetation is successful and meet the criteria of a 18.6 percent vegetative cover. The area will remain fenced to protect the seedlings until they are established during this two year period. Areas that were not successfully revegetated will be reseeded.

V. RECLAMATION PLAN (rule R613-004-110)

The heap leach area will be stabilized as described in the original application at the cessation of operations. In summary, following cessation of operations the heap leach pad area will be neutralized by sprinkling a neutralizing leach on the heap until monitoring indicated neutralization of the heap pile material. Following this, the operational 2:1 slopes will be flattened to 3:1 by pushing the material up toward the center of the heap pile. The pile will be contoured to simulate natural surface topography. Stockpiled topsoil will then be placed over the pile and seeded. Roads will be closed and stabilized, and all structures will be removed as well as all other improvements. A cross section of the proposed final heap leach pile in both plan and section are shown below on drawing 5.

The mine dump will be reclaimed by removing the dump material, discing the in-place topsoil, and reseeding with approved seed mixtures as described in the original application. The present and reclaimed mine dump area is shown in plan and section on Drawing 6.

ITEM 3) Pond closure and pipeline removal.

Refer to Exhibit E of North Lily Mining Company's Notice of Intent filed with the Division of Oil, Gas and Mining above.

ITEM 4) Contingency plans for neutralization and cleanup of accidental spills of chemicals and cyanide solutions. It must address the worst spill scenario for this project and appropriate action for containment, minimizing the damage and possible remedies.

The plant site will be developed to have secondary containment structures in the areas where potentially hazardous materials are to be stored or used. Pump stations at the leach pad and pipeline ditches will be lined and graded to drain into the respective facilities. The leach process area will also be lined and graded to drain into the solution ponds. A small amount of calcium hypochlorite will be onsite to assist in neutralizing any cyanide. In the unlikely event of a spill or pipeline rupture occurring which indicates the containment facilities, the following steps will be taken:

- a. The operation of the facility where the spill occurs will be shut down immediately and the shift foreman will be notified;
- b. The shift foreman will investigate the spill and report the conditions to the mine manager as soon as possible;

- c. The mine manager will report the spill to the Department of Environmental Quality, Division of Water Quality by phone within 24 hours in writing within 7 days after the spill
- d. The facility will be repaired and returned to operation as soon as possible; and
- e. The contaminated material will be neutralized and a disposal plan submitted for review and approval by the Department of Environmental Quality, Division of Water Quality and other regulatory agencies as appropriate.

ITEM 5) Post closure ground water monitoring

The production well NEL - 1, located in the Tintic Valley about 1 mile west of the plant will be sampled semi annual and assayed for the table I parameters described in Part I Section B of the Ground Water Discharge Permit, Permit No. Ut - UGW230001 for a two year period after closure.

Upon your review of the described items, if you have any questions or comments, please call. It is our intent to comply with the regulation adopted by the State and if for some reason we unknowing miss something we will do anything in our power to make it right.

Sincerely

Paul C. Spor  
General Manager

cc: Copy to Mr. Dave Rupp

#### 4.0 COVER DESIGN

The heap cover is one component of the overall system designed to minimize the potential of effluent from the closed heap to affect ground water. The other components are the Reclamation Plan (Section 5) and the Leachate Management Strategy (Section 6). The design of the cover will be principally driven by two factors which are the expected quality of the effluent following bioremedial treatment and the capacity and ability of a passive system to treat the expected effluent. A technology screening process has identified three heap capping methods available for closure of the Silver City heap. Following lab testing, the quantity of effluent expected to drain from the heap will be estimated utilizing the Hydrological Evaluation of Landfill Performance (HELP) model. A brief description of each cover design is below.

1. **Compaction of Spent Ore** - Following completion of heap grading and contouring, two samples of spent ore will be collected and sent to a commercial lab for analysis. A standard suite of compaction and permeability tests will be conducted. The goal of this program will be to determine the overall compaction and resultant permeability which can be achieved by compaction of spent ore. Based on visual examination of the spent ore and experience with similar materials, it is expected that permeability's of approximately  $1 \times 10^{-5}$  cm/sec. or lower can be achieved. Suitable compaction would be achieved by walking a bulldozer in an upslope direction. The surfaces would be sealed by repeated equipment passes. Alternatively, should test results indicate significantly improved permeabilities, the top 24 inches of the heap surface would be compacted in 6 inch lifts by use of heavy equipment.
  2. **Installation of a Gravel Drain Layer** - In the event that the compacted spent ore model results indicate an unacceptable quantity and quality of effluent, the performance of a 12 inch gravel drain layer over the compacted spent ore and under the replaced soil layer would be evaluated. The purpose of the gravel drain layer would be to reduce the amount of infiltration to the heap. The gravel would be locally obtained from North Lily's property.
  3. **Installation of an Enhanced Cover** - In the event that the compacted spent ore model results indicate an unacceptable quantity and quality of effluent, the performance of an enhanced cap would be evaluated. The modified cap would include addition of suitable clay or bentonite to the compacted spent ore to further reduce permeability.
- Following completion of the test and modeling results, a cover design would be selected and constructed.

## 5.0 REVEGETATION PLAN

Reclamation of the Silver City heap will include the placement of topsoil over the graded, compacted heap and seeding, mulching and fertilization in accord with the DOGM approved Reclamation Plan which is appended to this Closure Plan. There is adequate salvaged topsoil available to implement the plan. The operator has demonstrated the technical feasibility of the proposed Reclamation Plan by successful reclamation of the mine waste dumps which were the source of ore for the heap leach project. Revegetation success criteria have been established by DOGM.

## 6.0 LEACHATE MANAGEMENT STRATEGY

If necessary, effluent from the heap will be managed by routing it to a wetland system for passive treatment prior to release. There are basically two types of wetlands; natural and manmade. These systems have been successfully applied in the partial treatment of heap effluent in the west. The effectiveness of engineered systems is generally confined to flows of less than 100 gpm due to size limitations and exhibit metals removal efficiencies in the range of 50-75%. The decision to utilize either a simple constructed wetland system or more complex anaerobic bioreactor will be driven by the expected quality of the effluent following bioremedial treatment and the expected flow to the system from the capped, revegetated heap. Based upon an informed review of the site, climatological data and the expected performance of the heap cap and revegetation plan, it is expected that flow to the passive treatment system would average less than 10 gpm. The conceptual design of the passive treatment system and expected effects on ground water underlying the Silver City site would be reviewed with DEQ prior to construction of the proposed system.

Water would be directed from the heap pipe collection system to the passive treatment system. In the event that a manmade wetland is constructed, it may be preferable from a water quality standpoint to route the flow via an open ditch. Otherwise the flow will be routed via pipe. In any event, provision would be incorporated into the system to allow flow measurement and for the collection of water quality samples both above and below the passive treatment system. Treated effluent would be released via infiltration from a wetlands system or by a leach field if an anaerobic bioreactor were constructed. Ground water is located at a depth exceeding 300 feet in the Silver City area and clay seams are known to exist between the surface and the local water table.

## 7.0 FLUID DISPOSAL PLAN

It is planned that excess fluids from the heap flushing process will be disposed of by land application. This system of fluid disposal is well proven. The most significant benefit of direct land application relates to the attenuation of metals and not the evaporation of solution. The land application system would be operated in a manner to exclude overland flow and maximize infiltration and percolation of solution into the soils.

In addition to the possibility of applying excess rinse solutions to the seeded heap for irrigation, the operator has identified two potential areas for land application in close proximity to the Silver City heap. Both areas are private and controlled by North Lily. Soil samples were collected from both areas and submitted to the Colorado State University Soils Lab for analysis. All soils showed substantial capacity to adsorb metals without exceeding concentrations considered harmful to plant growth. The soil and rinse solution concentration data will be reviewed prior to implementation of land application of excess fluids.

**SILVER CITY OPERATIONS  
ADDENDUM I TO SECTION 7  
FLUID DISPOSAL PLAN  
HEAP CLOSURE PLAN**

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**MARCH 1997**

## ADDENDUM I

### 7.0 FLUID DISPOSAL PLAN

It is planned that excess fluids from the heap flushing process will be deposited of by land application. This system of fluid disposal is well proven. The most significant benefit of direct land application relates to soil attenuation of metals and not the evaporation of solution. The land application system would be operated in a manner to exclude overland flow and maximize infiltration and percolation of solution into the soils.

In addition to the possibility of applying excess rinse solution to the seeded heap for irrigation, the operator has identified two potential areas for application in close proximity to the Silver City heap. Both areas are private and controlled by North Lily. (These areas are identified on Figure 1.) Soil samples were collected from both areas (See Figure 1 for sample locations) and submitted to the Colorado State University Soils Lab for analysis. (Results of the soil analysis are show as Figure 2.) All soils showed substantial capacity to absorb metals without exceeding concentrations considered harmful to plant growth.

Rinse solution concentration has been monitored for the past three and a half years. Spillway samples and been taken and submitted to ChemTech a Utah Certified Lab for analysis. The following table outlines the progress to date on some of the metals and cyanide (all analysis are reported in mg/l):

PARAMETER	*GROUND WATER QUALITY STANDARD	DETECTED IN								
		JUL 93	MAR 95	JUN 95	SEP 95	DEC 95	MAR 96	JUN 96	SEP 96	DEC 96
Fluoride as F	2.4	1.60	2.49	4.94	5.2	5.7	3.5	5.9	1.6	5.4
Arsenic as As	0.05	0.916	0.604	0.59	0.814	0.500	1.3	0.63	0.44	0.31
Barium as Ba	2.0	<.1	0.016	0.018	0.02	<0.20	<0.05	0.02	0.02	<0.2
Cadmium as Cd	0.005	<.1	<.001	<.001	<0.01	<0.05	<0.025	<0.02	0.008	<0.1
Chromium as Cr	0.1	<.1	<.01	<.007	<0.01	<0.05	<0.025	0.041	0.040	<0.1
Copper as Cu	1.3	1110	340	283	255	188	162	161	102	80.2
Lead as Pb	0.015	<.2	0.088	0.066	0.100	0.100	<0.04	0.14	0.11	1.3
*Mercury as Hg	0.002	0.141	0.388	0.0020	0.232	0.329	0.39	0.40	0.27	0.31
Selenium as Se	0.05	0.529	0.140	0.24	0.17	0.024	0.03	<0.02	0.02	0.05
Silver as Ag	0.05	4.41	3.61	1.8	4.24	3.43	0.56	1.32	7.74	<0.1
Zinc As Zn	5.0	0.381	0.093	0.500	0.19	0.20	0.08	0.30	0.35	<0.2
Cyanide as CN-T	0.75	1480	344	256	300	*NOTE	163	149	91	62
Cyanide as CN-Wad	0.20	1264	77.6	239	291	169	153	156	93	64
pH	6.5 to 8.5	10.0	9.41	8.82	9.31	8.95	9.39	9.20	8.6	8.7

\* Administrative Rules For Ground Water Quality Protection - Effective Date of Last Revision - March 20, 1995

\* Digested analyzed by AWAL

As the above table indicates, the effluent coming from off the heap leach pads showed significant reductions in metals and total and wad cyanide levels for the past three years. North Lily is extremely pleased with the decrease in wad and total cyanide levels.

The amount of excess fluid that is planned for deposal by land application is estimated at 1,250,000

to 1,500,000 gallons or between 4 and 5 acre feet. These fluids will be deposited of on two sites; The first site is south of the heap leach pad and covers an area of approximately 180,000 sq ft or 4.13 acres, and the second site is west of the heap leach pad and across the highway and covers an area of approximately 360,000 sq ft or 8.26 acres. For a combined area of approximately 540,000 sq ft or 12.39 acres. If 250,000 gallons of excess fluid were evenly deposited of over the proposed sites less than one half gallon of fluid would be deposited of per square foot of ground.

Based on the following deposal rate, 100 gallons per minute for 8 hours per day a total of 48,000 gallons would be deposited per day. By alternating daily between sites 1 and 2 the excess fluids would be deposited of in approximately 31 days. (Note: Because site 2 is twice the size of site 1, it will be divided into two parcels thus each site of approximately 4.1 acres would receive excess fluid once every third day allowing for absorption and/or evaporation.) Deposal of excess fluids will not commence until the ground is free of snow and then only on days when temperatures are above 50 degrees Fahrenheit. On all rainy days, deposal of excess fluids will be suspended.

Based on the maximum amount of excess fluids estimated in the system the following amounts of metal, wad and total cyanide have been calculated to represent the total elements and compounds to be deposited of by land application (December 1996 rinse solution concentration levels were used). The following table outlines the projected results (Most of the soil analysis are reported in ppm calcium, magnesium, and sodium are reported in meq/l, all of the rinse solution values are reported as (Total amounts) in mg/l and the final column represents mg/kg in the 12.39 acres designated in site 1 and 2.):

PARAMETER	CURRENT SOIL LEVEL METALS/COMPOUNDS	DETECTED IN RINSE SOLUTION DEC 96	TOTAL mg/kg IN LAND APPLICATION AREA
Fluoride as F	N/R	5.4	1.12
Arsenic as As	0.69	0.31	0.06
Barium as Ba	N/R	<0.2	<0.04
Cadmium as Cd	0.09	<0.1	<0.02
Chromium as Cr	N/R	<0.1	<0.02
Copper as Cu	4.4	80.2	16.7
Lead as Pb	12.0	1.3	0.3
*Mercury as Hg	N/R	0.31	0.06
Selenium as Se	N/R	0.05	0.01
Silver as Ag	N/R	<0.1	<0.02
Zinc As Zn	1.59	<0.2	<0.04
Cyanide as CN-T	N/R	62	12.94
Cyanide as CN-Wad	N/R	64	13.36
pH	8.0	8.7	8.3
Phosphorus as P	4.4	0.13	0.03
Potassium as K	308	363	76
Iron as Fe	3.25	0.6	0.13
Manganese as Mn	1.9	0.188	0.04
Calcium as Ca	2.4	524	109.4
Magnesium as Mg	0.6	12	2.5
Sodium as Na	0.4	6710	1400

Although several of these elements will show higher than back ground levels of concentrations in the land application areas none of the elements are harmful to plant life. Within several years most of the soil in the land application area will return to its natural state.

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DATE RECEIVED: 07-12-96

DATE REPORTED: 08-02-96

(970) 491-5061 FAX: 491-2930

BOLLING:

# RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	paste		Lime estimate	OM %	AB-DTPA							Texture estimate
		pH	EC mhos/cm			NO <sub>3</sub> -N	P	K	Zn	Fe	Mn	Ca	
R157	W1	8.3	1.1	Low	1.5	14	14.6	254	0.61	2.6	3.1	3.5	Clay Loam
158	W2	7.8	0.4	Medium	1.5	2	1.8	270	1.40	4.7	1.7	5.2	Clay Loam
159	W3	8.1	0.4	Medium	1.5	2	1.8	283	0.87	3.0	1.5	4.1	Clay Loam
160	W3	7.8	0.3	Low	1.5	2	2.6	387	0.83	3.0	1.6	3.2	Clay Loam
161	S1	7.9	0.3	High	1.5	1	2.1	299	1.80	4.3	2.2	3.4	Clay Loam
162	S2	8.1	0.3	High	1.3	1	2.8	316	1.60	2.6	1.7	4.8	Clay Loam
163	S3	8.1	0.3	High	1.4	2	4.9	345	4.40	2.9	2.2	6.1	Clay Loam
164	S4	8.1	0.3	High	1.6	1	4.3	313	1.20	2.9	1.3	5.2	Clay Loam

Lab #	Sample ID #						AB-DTPA			
		Ca	Mg mg/l	Na	K	SAR	Cd	Pb	As	
										ppm
R157	W1	2.6	1.0	0.5	0.1	0.4	0.06	3.1	1.32	
158	W2	2.7	0.8	0.6	0.2	0.5	0.11	10.3	0.50	
159	W3	2.2	1.0	0.3	0.1	0.3	0.08	6.1	0.58	
160	W3	2.3	0.8	0.4	0.2	0.3	0.07	3.4	0.50	
161	S1	2.4	0.3	0.3	0.1	0.2	0.09	22.7	0.95	
162	S2	2.2	0.3	0.4	0.1	0.4	0.09	16.0	0.85	
163	S3	2.3	0.3	0.4	0.1	0.4	0.14	24.5	0.29	
164	S4	2.4	0.3	0.4	0.1	0.4	0.07	9.6	0.56	

Figure 2

36  
35

SILVER CITY ROAD

HEAP  
LEACH  
PAD

PREG  
POND

OVERFLOW  
POND

BARREN  
POND

TOP SOIL  
STORAGE

U.S. HIGHWAY 6 & 50

SAMPLE LOCATION

X  
W1

X  
W2

WEST LAND APPLICATION SITE

This page is a reference page used to track documents internally for the Division of Oil, Gas and Mining

Mine Permit Number M02300067 Mine Name Tintic Project  
Operator North Lily Date 9-30-1996  
TO \_\_\_\_\_ FROM \_\_\_\_\_

☐ CONFIDENTIAL ☐ BOND CLOSURE ☐ LARGE MAPS ☒ EXPANDABLE  
☐ MULTIPUL DOCUMENT TRACKING SHEET ☐ NEW APPROVED NOI  
☐ AMENDMENT ☐ OTHER \_\_\_\_\_

Description

YEAR-Record Number

☐ NOI ☒ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

Silver City Operations  
Heap Closure Plan

☐ NOI ☐ Incoming ☐ Outgoing ☐ Internal ☐ Superceded

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☐ TEXT/ 8 1/2 X 11 MAP PAGES ☐ 11 X 17 MAPS ☐ LARGE MAP

COMMENTS: \_\_\_\_\_

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